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Mr. Desor exhibited a minute crustacean animal, found in Cochituate water, with a drawing of the same, which he pronounced to be a species of *Calanus*.

Three hundred and sixteenth meeting.

February 6, 1849. — MONTHLY MEETING.

The VICE-PRESIDENT, Mr. Everett, in the chair.

The Corresponding Secretary read a letter from Professor Arnold Guyot, signifying his acceptance of the Fellowship of the Academy. He also read a communication from Mr. James D. Dana, of New Haven, upon the importance of having a larger edition of the scientific works embodying the results of the United States Exploring Expedition under Captain Wilkes. Whereupon the President was requested to address the Joint Library Committee of Congress, and to call attention to the memorial presented by the Academy upon that subject, on a former occasion.

Professor Peirce, from the committee appointed on that subject, read the following report upon the results of the United States Coast Survey, and it was ordered that a copy thereof be forwarded to Dr. Bache, the Superintendent of the Survey, and another to the Hon. Robert C. Winthrop, Speaker of the House of Representatives.

“The committee of the American Academy of Arts and Sciences, to which were referred the report of the Superintendent of the United States Coast Survey, and the letter of the Superintendent requesting the opinion of the Academy thereupon, respectfully submit the following report.

“The present Superintendent of the Coast Survey of the United States was designated, in 1843, as the proper successor of Mr. Hassler, with extraordinary unanimity, by the science of the whole country. It was believed that his great scientific capacities, nurtured at West Point, and grown to maturity under the most favorable opportunities for development in his own country and during his European travels, united with his admirable judgment and enlarged administrative ability,

were precisely adapted to the conduct of this national work, so important to commerce and navigation, and so interesting to science. After the lapse of five years from the date of his appointment, it is deemed reasonable to comply with Professor Bache's request to make a careful examination of his labors, and inquire if the high expectations which had been formed have been realized; if there has been so rich a harvest of valuable results as might have been anticipated; if the best methods of observation have been uniformly adopted; and if the survey has been conducted throughout with proper economy and despatch. Your committee have made this examination to the best of their ability, and have thought it advisable to present their conclusions in as simple and condensed a form as possible. The tone of the report is necessarily laudatory, for the committee are persuaded that the minutest and most conscientious scrutiny will find every thing to approve and nothing to condemn.

"1. The methods and instruments of observation appear to be, in all cases, the most convenient and accurate which are known; while, in some striking instances, they are such as were not known or tried in geodetical operations before they were introduced upon this survey. It is, moreover, grateful to record, that some of the most important of these improvements are of American origin. The committee beg leave to refer to some examples.

"The apparatus for measuring the base-lines is so portable, that six and three fourths miles are measured in ten working-days, and so accurate, that the whole amount of possible error in this distance would not exceed half an inch. This beautiful apparatus, which is incomparably superior to any which has ever before been adopted, is in principle and combination the invention of the Superintendent himself. It is a compensating system, and is in this respect closely allied to the elegant arrangement invented and used by Mr. Borden in the survey of the State of Massachusetts, but the method of compensation is novel and original in an essential and characteristic feature.

"The method which has been finally adopted for the measurement, astronomically, of differences of latitude is that which was invented by Captain Talcott, late of the Corps of Engineers of our army, and which had not before been used for geodetical purposes. A full description of this method has been recently published in an unusually handsome form by the Topographical Bureau of the War Department, in a memoir written by Captain T. J. Lee, which contains some exam-

ples from the Coast Survey observations. From this publication, it appears that the latitude is given, by a single night of observation, to the fraction of a second of arc, and that in four or five nights it can be determined with the minutest accuracy of which astronomical measurement is susceptible. The instrument employed is of simple construction, and of little cost, while its accuracy must render it available for some most delicate geodetic and geological researches. It is not impossible that, in the hands of a skilful geologist, it may aid in determining the various densities of the crust of our globe, and thereby serve as a divining-rod for detecting its internal wealth; and it may thus give birth to a new species of practical astrology.

“The use of Morse’s magnetic telegraph for the determination of astronomical differences of longitude was too obvious to escape early notice, but it was reserved for the Coast Survey to ascertain its practicability as an exact method. This has been done by a series of refined and careful observations, made under the direction of Mr. Sears C. Walker, from which it appears that differences of longitude thus determined can be employed in the measurement of the earth in a direction perpendicular to the meridian. This conclusion is of great importance in reference to the survey of a coast which deviates from the arc of a meridian so much as that of the United States. The introduction of clockwork into the magnetic operations will undoubtedly contribute to their accuracy, although it remains to be seen which of the different plans that have been devised will be the preferable one.

“Professor Bache’s method of employing the great theodolite in the primary triangulation must command the admiration of experienced observers for its conscientious accuracy, and its skilful and faithful determination of every correction and every source of error. His measured angles have rewarded his patience and perseverance, by submitting to the usual tests with a uniform exactness which has never been surpassed, and which proves that one fifth of a second of arc is the greatest error to which any one of his angles is liable. This extraordinary accuracy is not attained at any sacrifice of time; but, on the contrary, the present Superintendent has completed the observations at each station in much less time than was required by his predecessor, because he has rejected an unnecessary and injudicious rule in regard to the selection of days of observation.

“All the other portions of the field work, whether of the reconnaissance, of the primary, secondary, or tertiary triangulation, or of the

topography or hydrography, and also the office work, are distinguished for the same scrupulous regard to accuracy and despatch. The observations, indeed, which are made in the field by one set of officers, are reduced and plotted by others in the office, so that there can be no danger of any deception, and every thing must be as good as it appears. The observations of the Superintendent himself are not excepted from this ordeal.

“The committee cannot pass from this head of their inquiry without expressing their commendation of the beautiful execution of the charts, and of the wise liberality with which they are furnished to navigators at a trifling cost.

“2. The survey has already embraced a very extensive portion of the coast, and numerous discoveries have been made of the highest importance to navigation. ‘The field or office work of the survey has been carried into every State on the Atlantic and the Gulf of Mexico, except one.’ Every year results have been obtained of a mercantile value incomparably superior to their cost, and which would be sufficient to pay, again and again, for the whole year’s work. To say nothing of the many important discoveries of useful channels, or of hidden and unknown dangers, in Long Island Sound, in Buzzard’s, Massachusetts, Chesapeake, and Mobile Bays, who can estimate the value of Gedney’s Channel* to New York harbour? of the determination of the changes in the main ship-channel, which have been so gratefully acknowledged by the Chamber of Commerce of New York? or of Blake’s new channel in Delaware Bay? or of Davis’s discoveries of the shoals in the vicinity of Nantucket, for which the insurance-offices of Boston and New York have acknowledged their obligation? Is not each of them separately worth the whole amount which has been expended upon the work? But leaving these remarkable discoveries to the merchants and sailors who are most competent to appreciate them, your committee would draw the attention of the Academy to some other results, of a less practical, but no less scientific, interest.

“3. From the variety of his scientific attainments, the attention of the Superintendent has been readily drawn to all classes of observations which would conduce to the progress of science, and which could be made by himself or any of his parties without obstructing their other duties. Thus the abstruse problem of the figure of the earth will undoubtedly receive its due consideration when the primary triangula-

* Gedney’s and Blake’s Channels were discovered during the administration of Mr. Hassler.

tion is completed ; and also the local variations of figure in connection with those differences of internal density, the detection of which is already to be enumerated as one of the scientific discoveries which have been made upon the survey.

“ The intricate problem of the tides, also, which is still so defective, notwithstanding the labors of Laplace, Airy, Lubbock, and Whewell, will undoubtedly receive new development from the observations of the survey, and the laws of the tides upon the American coast will be ascertained.

“ The exploration of the Gulf Stream, which was commenced by Lieutenant Davis, and so indefatigably pursued, even to the sacrifice of his life, by the lamented George M. Bache, has led to results which are of profound scientific importance ; and the deep-sea soundings, which have been examined by Professor Bailey, are also replete with interest to the naturalist.

“ 4. Your committee have few data for arriving at any definite conclusion with regard to the extent of the economy with which the survey has been conducted. They are not, however, aware of any objection to the comparison which has been instituted by the Superintendent with the surveys of the Land Office, and which is very favorable to the Coast Survey. There is certainly no appearance of waste or extravagance in any respect ; there are no excessive salaries, no idle *attachés*, nor any apparent disposition to pay too much for services rendered. There seems, on the contrary, to be an anxious desire to husband the appropriations of Congress, and to derive from them the largest possible return of valuable results. It is especially deserving of notice, that the Superintendent has manifested the wisest and most unselfish economy in asking for large appropriations, in order that he may press forward the work as rapidly as possible to its final completion.

“ In conclusion, it is the deliberate opinion of the committee, that the present Superintendent of the United States Coast Survey has, by his able and judicious, his energetic and economical administration of this great national work, raised it to the highest state of successful activity and deserved popularity, and that he has thereby fulfilled the high expectations which were raised at his appointment.

“ All of which is respectfully submitted by

BENJAMIN PEIRCE,
DANIEL TREADWELL,
J. I. BOWDITCH,
JOSEPH LOVERING.”

Professor Lovering, in the absence of the chairman of the Rumford Committee, read the following report on a communication of Mr. James Frost, which was referred to that committee.

"The Rumford Committee, having examined the paper submitted by James Frost, Esq., of Brooklyn, New York, and entitled, 'Description of the Causes of the Explosion of Steam-boilers, and of some newly discovered Properties of Heat, and other Matters: for the Purpose of showing that the Application of Steam for the Production of Motive Force is susceptible both of immense Improvement and Economy,' respectfully report:—

"The chief points which the author claims to have established are, —

"1st. That steam of 212° Fahr., heated, out of contact with water, to 216° , doubles its volume; and heated to 228° , increases its volume threefold.

"2d. That steam of low tension, heated to somewhere about 650° , is converted into another body, which the author calls 'stame,' and which, under favorable circumstances, becomes six times as effective as steam not so heated.

"As, in the view of the author, the question of discovery rests upon the truth of the first of these two propositions, the attention of the committee has been particularly directed to its consideration. To this end, the apparatus employed by Gay-Lussac in his determinations of the tension of aqueous vapor at different temperatures was constructed, and a series of experiments made upon steam heated, out of contact with water, from the boiling point to $233^{\circ}.6$. The results arrived at were as follow.

"A volume of steam at 212° Fahr., measuring 15.80 cubic centimetres, or 1580 parts, heated to 216° , became 1600 parts, and heated to 228° , became 1630 parts. According to Mr. Frost, 1580 parts at 212° should have become 3160 parts at 216° , and 4740 parts at 228° . In tabular form we have, at

	Exp.	Frost.	Dif.
212°	1580	1580	—
216°	1600	3160	1560
228°	1630	4740	3110

"The results for higher, intermediate, and lower temperatures are

given in the accompanying table. The whole expansion of the steam, when heated from 212° to 228° , was a little more than one thirtieth of its volume at 212° . According to Mr. Frost, it should have been more than ninety times as great as the committee found it to be.

“The experiments of the committee were made with steam under a pressure ranging from 24 to $24\frac{1}{2}$ inches of mercury, that is, under less than atmospheric pressure. This condition could not influence the result unfavorably to the view of Mr. Frost, since the less the pressure, the greater is the expansion with a given elevation of temperature.

Centigrade.	Fahrenheit.	Volumes.	Centigrade.	Fahrenheit.	Volumes.
112°	233.6°	1644	102°	215.6°	1600
111.5	232.7	1642	101.5	214.7	1598
111	231.8	1640	101	213.8	1592
110.5	230.9	1638	100.5	212.9	1588
110	230.0	1634	100	212.0	1580
109.5	229.1	1632	99.5	211.1	1574
109	228.2	1630	99	210.2	1560
108.5	227.3	1628	98.5	209.3	1510
108	226.4	1626	98	208.4	1430
107.5	225.5	1624	97.5	207.5	1280
107	224.6	1622	97	206.6	1130
106.5	223.7	1620	96	204.9	870
106	222.8	1618	95	203.0	650
105.5	221.9	1616	94	201.2	550
105	221.0	1614	93	199.4	350
104.5	220.1	1610	92	197.6	200
104	219.2	1608	91	195.8	150
103.5	218.3	1606	90	194.0	125
103	217.4	1604	70	158.0	000
102.5	216.5	1602			

“The committee deem it unnecessary to consider farther the claims of the alleged newly discovered properties of heat, as set forth in the pamphlet of Mr. Frost.

E. N. HORSFORD,
JOSEPH LOVERING,
DANIEL TREADWELL,
BENJAMIN PEIRCE.”

Mr. Foster, of the United States Survey of the Mineral Lands of Lake Superior, being present by invitation, read the subjoined paper.

“ On Certain Phenomena connected with the Rise and Fall of the Waters of the Northern Lakes.

“ During a residence of several summers on the borders of Lake Superior, my attention has been directed to the question, whether its waters were subject to any movement corresponding to the tidal action, and the result of my observations has been, to convince me that they do not rise and fall at stated periods, corresponding to the ebb and flow of the tide. On the other hand, abundant evidence exists that the waters are subject to extraordinary risings, which are independent of the influence of the sun and moon.

“ The late Governor Dewitt Clinton * published a memoir on this subject, which embodies many interesting facts. As that memoir is not readily accessible, we will extract such facts as are deemed most important. These risings attracted the attention of the earliest voyageurs in this region. La Hontan relates the following incident : — ‘ On the 29th of May, 1689, we came to a little deep sort of a river, which disembogues at a place where the water of the lake [Michigan] swells three feet high in twelve hours, and decreases as much in the same compass of time. Our tarrying there for three or four days gave me an opportunity of making the remark.’ Charlevoix,† who traversed the Lakes nearly a century ago, in reference to Lake Ontario says : — ‘ I observed that in this lake, and I am told that the same thing happens in all the rest, there is a sort of flux and reflux, almost instantaneous, the rocks near the banks being covered with water and uncovered again several times in the space of a quarter of an hour, even if the surface of the lake was very calm, with scarce a breath of air. After reflecting for some time on this appearance, *I imagined it was owing to springs at the bottom of the lake, and to the shock of their currents with those of the rivers which fall into them from all sides, and thus produce those intermitting motions.*’ Mackenzie,‡ who wrote in 1789, remarks : — ‘ A very curious phenomenon was observed at the Grand Portage on Lake Superior, for which no obvious cause could be assigned. The water withdrew with great precipitation, leaving the ground dry which had never before been visible, the fall being equal to four perpen-

* *Transactions of the New York Literary and Philosophical Society*, Vol. II., Part I.

† *Journal Historique d'un Voyage de l'Amérique*, L. XIII.

‡ *Voyage to the Frozen and Pacific Oceans*.

dicular feet, and rushing back with great velocity above the common mark. It continued thus rising and falling for several hours, gradually decreasing, until it stopped at its usual height.'

"Governor Clinton relates the following incident, which happened to Colonel Bradstreet, who commanded an expedition against the Western Indians in 1764: — 'In returning by way of Lake Erie, when about to land the troops one evening, a sudden swell of the lake, without any visible cause, destroyed several of his boats, but no lives were lost. This extraordinary event was looked upon as the precursor of a storm, and accordingly one soon occurred, which lasted several days.' The following occurrence, also related by him, took place on the British side of Lake Erie, on the 30th of May, 1823: — 'A little after sunset, Lake Erie was observed to take a sudden and extraordinary rise, the weather being fine and clear, and the lake calm and smooth. It was principally observed at the mouths of Otter and Kettle Creeks, which are about twenty miles apart. At Otter Creek, it came in, without the least previous intimation, in a swell of nine feet perpendicular height, as was afterwards ascertained, rushed violently up the channel, drove a schooner of thirty-five tons burden from her moorings, threw her upon high ground, and rolled over the ordinary beach into the woods, completely inundating all the adjacent flats. This was followed by two others of equal height, which caused the creek to retrograde a mile and a half, and to overflow its banks, where water was never before seen, by seven or eight feet. The noise occasioned by its rushing with such rapidity along the winding channel was truly astonishing. It was witnessed by a number of persons. At Kettle Creek, several persons were engaged drawing a fish-net in the lake, when suddenly they saw the water coming upon them in the manner above described, and, letting go their net, they ran for their lives. The swell overtook them before they could reach the high bank, and swept them forward with great force, but being expert swimmers they escaped unhurt. The man who was in the skiff, pulling in the sea-line, was driven a considerable distance over the flat, and grounded upon a small eminence, where he remained until the water subsided. There were three successive swells, as at Otter Creek, and the effects were the same, with this difference, — the water rose only seven feet. In both cases, the lake, after the swells had spent their force, gradually subsided, and in about twenty minutes was at its usual height and tranquillity.'

“In 1828, Governor Cass instituted a series of experiments, at the head of Green Bay, to determine the changes in the water-level. These observations extended from the 15th of July to the 30th of August, and from them he infers ‘that the changes in the elevation of the waters are entirely too variable to be traced to any regular permanent cause, and that consequently there is no perceptible tide at Green Bay which is the result of observation. And such, it appears to me, is the result of calculation, when the laws that regulate solar and lunar attraction are taken into view.’* ”

“In the summer of 1834, an extraordinary retrocession of the waters took place at Sault St. Marie, the outlet of the lake. The river at this place is nearly a mile wide, and in the distance of a mile falls 18.5 feet. Its bed is sandstone, and, except in the immediate channel, the average depth of water is two and a half feet. The phenomenon occurred about noon. The day was calm, but cloudy. The water retired suddenly, leaving the bed of the river bare, except for a distance of thirty rods, and remained so for nearly an hour. Persons went out and caught fish in the pools formed in the depressions of the rocks. The return of the waters is represented as having been very grand. They came down like an immense surge, and so sudden was it, that those engaged in catching fish had barely time to escape being overwhelmed.

“A similar phenomenon occurred twice on the same day in the latter part of April, 1842. The lake was free from ice, and no wind was prevailing in the vicinity.

“A few years previously, the precise period my informants could not designate, the current between the foot of the rapids and Fort Brady, which usually flows at the rate of two and a half knots an hour, was observed to set back. The water rose two feet or more, and the rate of the back-current was estimated at two knots an hour. Some of the soldiers at the fort, in order to satisfy themselves, jumped into a boat and rowed into the stream, when they found the current bearing them towards the foot of the rapids. How long this continued, my informants could not designate. A strong wind was prevailing from the south, but it was never before known to have

* Remarks on the Supposed Tides and Periodical Rise and Fall of the North American Lakes, by Major (now Brigadier-General) Henry Whiting, *American Journal of Science*, Vol. XX., Part II. See also a paper by General H. A. S. Dearborn, *Ibid.*, Vol. XVI.

produced such an accumulation of water. These facts I gathered from Mr. Hulburt, Ashmun, and Peck, old residents of Sault St. Marie.

“I have witnessed numerous ebbings and flowings of the waters of Lake Superior.

“In the month of August, 1845, I was coasting in an open boat from Copper Harbour to Eagle River. It was late in the afternoon, and the lake was calm. To the northwest, the clouds indicated that different strata of air were moving in opposite directions. Mirage was beautifully displayed, and I was occupied in tracing out islands, with bold cliffs and spacious harbours, which had no real existence, when suddenly the water about a mile to the northwest was lifted up like a conical hill, to the height of apparently twenty feet, and swept towards the shore, diminishing in size as it advanced. The voyageurs saw it as it came rolling like a great breaker crested with foam, and headed the boat so as to cut the wave. It struck us without doing any injury, and was succeeded by two or three dead swells, when the lake resumed its former tranquillity. The cause which uplifted the water was local, and operated but for a moment. The swell could not, like the *bore* observed at the mouth of the Amazon, have resulted from opposing currents.

“While at Rock Harbour, Isle Royal, in the summer of 1847, I witnessed, on one occasion, the alternate rise and fall of the water, recurring at intervals of ten or fifteen minutes, during an entire afternoon. The variation was from twelve to twenty inches. The day was calm and clear, but the barometer was falling. Before the expiration of forty-eight hours, a violent gale set in.

“On the 23d of July last, I went from Copper Harbour to Eagle River, where I arrived in the evening. The day had been calm, so much so that a sail was useless. In the evening, there sprang up an off-land breeze, as is frequent; but notwithstanding, I observed a strong current flowing into Eagle River. The next day, a storm came on which continued for several days.

“I have witnessed the ebb and flow of the water through the narrow inlets and estuaries, particularly at Copper Harbour, when there was not a breath of wind on the lake. Similar phenomena have been noticed on the Swiss Lakes Constance and Geneva, which are there called *seiches*.

“I have already given Charlevoix's theory to account for them. Volney supposed that Lake Ontario was the seat of an ancient volcano,

which occasionally afforded signs of being not entirely extinct, and Governor Clinton was inclined to connect them with earthquake movements. Professor Mather, who observed the barometer at Copper Harbour during one of these fluctuations, remarks : — ‘As a general thing, fluctuations in the barometer accompanied fluctuations in the level of the water ; but sometimes the water-level varied rapidly in the harbour, while no such variations occurred in the barometer at the place of observation.’*

“As a general rule, these variations in the water-level indicate the approach of a storm, or a disturbed state of the atmosphere. The barometer is not sufficiently sensitive to indicate the sudden elevations and depressions, recurring, as they often do, at intervals of ten or twelve minutes, and the result of observations at such times may be regarded in some degree as negative.† Besides, it may not unfrequently happen, that, while the *effects* are witnessed at the place of observation, the *cause* which produced them may be so far removed as not to influence the barometer.

“From all the facts, we are led to infer that these phenomena result, not from the prevalence of the winds acting on the water, accumulating it at one point and depressing it at others, but from sudden and local changes in the pressure of the atmosphere, giving rise to a series of barometric waves. The water, conforming to the laws which govern two fluids thus relatively situated, would accumulate where the pressure was the least, and be displaced where it was the greatest.

“Again, as has been remarked by De la Beche, a sudden impulse given to the particles of water, either by suddenly increased or diminished pressure, would cause a perpendicular rise or fall, in the manner of a wave, beyond the height or depth strictly due to the mere weight itself. The difference in the specific gravity of the water of the lakes

* *American Journal of Science*, Vol. VI. (Second Series), July, 1848.

† De la Beche (*Survey of Cornwall*), quoting from the MSS. of Mr. Walker, who has devoted much time to the phenomena of tides, says : — “He has found that changes in the height of the water’s surface, resulting from changes in the pressure of the atmosphere, are often noticed in a good tide-gage *before* the barometer gives notice of any change. . . . If tide-gages at important dock-yards show that a sudden change of sea-level has taken place, indicative of suddenly decreased atmospheric weight, before the barometer has given notice of such change, all that time which elapses between the notices given by the tide-gage and barometer is so much gained, and those engaged with shipping know the value of even a few minutes before the burst of an approaching hurricane.”

and the ocean may cause these changes to be more marked in the former than in the latter."

The subject was further discussed by Professor Rogers and Mr. Desor.

Professor Agassiz addressed the Academy upon animal morphology, presenting some original views which he had recently developed upon this subject.

Mr. Bond made the following astronomical communications, viz. :—

1. *Observations on the Satellite of Neptune, made at the Cambridge Observatory, 1847–48.*

Cambridge Mean Solar Time.	Angle of Po- sition.	Dis- tance.	No. of Obs.	Obs- erver.	Pow- er.	Remarks.
1847. d. h. m.	°	"				
Oct. 25 7 45	230.0	15.4	3	B ¹	300?	{ Neither the angle of position nor the distance is well determined.
" 27 7 40	238.8	13.5	3	B ¹	300	
" " 7 40?	232.2	13.8	4	B ²	1200	
" 28 7 15	47.5	14.7	3	B ¹	400	{ The satellite is seen without difficulty, and the observations are supposed to be good.
" " 8 15	46.0	15.2	6	B ²	1200	
" 30 7 00	217.9	15.6	3	B ²	400	Very fine definition. Obs. uncertain from Dense fog. Satellite faint. [clouds.
Nov. 2 7 15	34.2	14.0	5	B ²	400?	
" 3 7 00	51.4	12.6	4	B ¹	400?	
" 26 7 05	49.9	15.3	10	B ¹	400?	
" " 7 47	40.1	16.6	5	B ²	1200	
1848.						
July 3 15 47	221.0	16.2	8	B ²	1200	{ Satellite occasionally obscured by clouds; otherwise it is well seen.
" " 16 40	217.2	16.2	6	B ¹	1200	
" 11 15 15	24.3	12.0	2	B ²	1200?	Fine definition. Obs. interrupted by daylight. Measures very difficult, from haze and moonlight.
" 21 15 0	234.0	16.2	5	B ²	860	
Aug. 31 10 17	225.0	17.1	6	B ²	860	Satellite well seen.
" " 10 46		16.1	8	B ¹	860	
Oct. 11 7 50	219.8	16.4	6	B ²	860	Bad seeing.
" 12 10 10	245.0	9.6	3	B ¹	860	
" 20 9 54	41.3	15.7	6	B ²	860	
" " 10 10?		15.8	5	B ¹	860	
" 23 7 35	219.5	15.6	5	B ¹	860	
" " 8 05	223.0	17.0	5	B ²	860	
" 28 8 00?	211.8	11.2	3	B ²	1500	Observations difficult.
Nov. 1 7 00	221.5	16.5	4	B ²	860	Bad seeing.

"The light of the satellite we have found to be nearly equivalent to that of a star of the fourteenth magnitude, as stars of that class, brought as near to Neptune as is its satellite, about equal the latter in faintness.

"Under good definition, Neptune shows a round disk, distinguishing it from stars of the same brightness. Its color is bluish, resembling the light of Uranus. We have more than once noticed an appearance somewhat of the nature of that from which Mr. Lassell has inferred

the existence of a ring ; but whether it is caused by a ring, or by the inner satellites which probably exist, or whether it be only an optical appendage, it would be difficult to determine.

“ The important object in view in these observations has been the determination of the mean distance of the satellite, in order to ascertain the mass of Neptune. For this purpose measurements near the times of greatest elongation are most valuable. On five occasions, namely, Nov. 26, 1847, July 3, Aug. 31, Oct. 20, and Oct. 23, 1848, the satellite has been observed in this position. The elements of the satellite’s orbit from these observations, as computed by Mr. G. P. Bond, are :—

Periodic time, 5.8752 days.

Inclination, 30°

Ascending node, 300° if the motion be *direct*.

Passage of ascending node, 1848, Oct. 30.37, Greenwich M. S. T.

Mean distance, 16."3 at the mean distance of Neptune.

“ These elements have been found by comparing the places of the satellite computed from Professor Peirce’s orbit, published in the first volume of the Proceedings of the American Academy, p. 295, with those observed, and thence deducing small corrections for the epoch, period, and mean distance, so as best to satisfy the whole series of *distances*. The following table shows the agreement between the observed and computed places in the corrected orbit.

	Distance. Comp. — Obs.	Position. Comp. — Obs.
1847, Oct. 25,	— 0.3	+ 0.3
“ “ 27,	+ 0.3	+ 5.4
“ “ 28,	— 0.4	+ 3.2
“ “ 30,	— 1.4	— 3.7
“ Nov. 2,	+ 0.8	+ 1.8
“ “ 3,	+ 1.1	+ 0.6
“ “ 26,	+ 0.1	— 1.2
1848, July 3,	+ 0.4	+ 4.1
“ “ 11,	— 0.4	+ 3.5
“ “ 21,	+ 0.5	— 5.8
“ Aug. 31,	+ 0.2	— 1.3
“ Oct. 11,	— 0.1	+ 0.6
“ “ 12,	— 0.1	— 2.2
“ “ 20,	+ 0.5	+ 3.3
“ “ 23,	+ 0.1	+ 2.6
“ “ 28,	+ 0.1	— 3.7
“ Nov. 1,	— 0.7	— 2.8

“ The corresponding mass of Neptune is $= \frac{1}{194000}$.”

2. *Observations on Encke's Comet, 1848, made at the Cambridge Observatory.*

Cambridge Mean Solar Time.	Comet's Mean A. R., Jan. 1, 1848.	Comet's Mean Dec., Jan. 1, 1848.	No. of Obs.
1848. d. h. m. s.	h. m. s.		
Aug. 27 14 01 44	3 19 28.0	+31 57 01	1
" 29 12 50 53	3 23 31.2	32 36 29	13
" 30 12 57 36	3 25 46.2	32 57 47	11
" 31 12 40 01	3 27 58.9	33 19 03	10
Sept. 5 15 56 49	3 40 36.2	35 17 13	6
" 26 11 26 24	5 07 49.4	46 23 42	10
Oct. 8 16 35 57	7 26 35.9	53 03 36	6
" 27 17 30 39	12 19 51.7	25 05 29	8
Nov. 3 17 33 38	13 07 48.4	11 06 18	6
" 5 17 29 34	13 18 14.7	+ 7 43 58	6
" 13 17 56 08	13 53 52.5	- 3 34 57	10
" 20 18 17 33	14 25 18.8	11 38 55	4
" 21 18 17 02	Compared with Mercury.		2
" 25 18 05 20	14 52 59.4	-16 44 49	4

Date.	Dif. A. R. Comet — Star.	Dif. Dec. Comet — Star.	Star A. R. Jan. 1, 1848.	Star Dec. Jan. 1, 1848.	Mag.
	m. s.	' "	h. m. s.	' "	
Aug. 29	-0 09.33	+5 35.2	3 23 40.54	+32 30 54.3	10
30	-0 18.97	-3 51.3	3 26 05.22	33 01 38.3	11
31	-1 20.05	-2 20.8	3 29 19.00	33 21 23.7	9
Sept. 5	-0 05.70	+1 53.5	3 40 41.87	35 15 19.2	9
26	-0 25.40	-3 51.0	5 08 14.79	46 27 33.2	9
Oct. 8	-1 20.22	+2 44.6	7 27 56.10	53 00 51.6	7
27	-0 06.38	+1 21.8	12 19 58.13	25 04 07.1	8
Nov. 3	-0 21.10	+3 02.3	13 08 09.51	11 03 15.7	9
5	-1 41.06	+1 54.1	13 19 55.74	+ 7 42 04.0	9
13	+0 04.18	-0 11.8	13 53 48.30	- 3 34 45.6	8
20	-3 36.28	+0 25.5	14 28 55.07	11 39 20.5	7
21 at 18 17 02 ♀ A.R. — Comet's A. R. = +7 29 35 by two comparisons.					
18 05 36 ♀ Dec. — Comet's Dec. = +5 44.3 by one comparison.					
25			14 42 28.75	-15 24 24.0	3

"The observation on the 27th of August was an instrumental reading corrected by a neighbouring star. 'The comet is a misty patch of light, faint and without concentration.' 'Its light is coarsely granulated, so that, were it not for its motion, it might be mistaken for a group of stars of the 21st magnitude.'

"Aug. 30th. A slight elongation is suspected in the direction south-preceding, position 240°.

"Aug. 31st. The comet is close to a star of the 12th magnitude, which interferes with the observations.

"The determinations on the 29th, 30th, and 31st may be uncertain to the amount of 10" or 15". The difficulty arises not so much from the faintness of the comet as from its want of concentration.

"Sept. 26th. The comet shows a brush of light towards the sun.

"Oct. 8th. Comet just visible to the naked eye. The brighter portion is very eccentrically situated with respect to the general mass. The fan-shaped brush of light is very evident on the side *towards* the sun, the angle of the sides opening by 75° or 80° . There is no other appendage which can be called a tail.

"Oct. 27th. The general mass of light is on the side of the nucleus, *towards* the sun; a faint ray, probably the commencement of the true tail, is thrown out on the side opposite to the sun.

"Nov. 3d. The comet shows a tail of 1° or 2° . The same remarkable appearance of a double tail presents itself as in October. It is plainly visible to the naked eye.

"Nov. 5th. Star of comparison is double, distance $10''$; that north-preceding is used.

"Nov. 13th. Strong daylight; comet shows an almost sparkling central point.

"Nov. 21st. The comparisons with Mercury are corrected for refraction and for the planet's motion in the intervals of transit.

"Nov. 25th. The comet was caught sight of in the morning twilight at an altitude of about 3° , and immediately compared with α^2 Li-bræ, which was near it. Four instrumental comparisons were obtained. After correction for differences of refraction and allowing for the comet's motion, the observed places of the comet differed among themselves in A. R. by $0^{\text{m}}.7$, and in Dec. by $13''$."

3. *Observations on the Eighth Satellite of Saturn (Hyperion) made at the Cambridge Observatory.*

Cambridge Mean Solar Time.	Distance from Saturn's Centre.	Cambridge Mean Solar Time.	Distance from Saturn's Centre.
1848.		1848.	
Sept. 19.56	+ 256	Oct. 21.42	— 206
21.52	+ 220	23 42	— 178
22.44	+ 192	27.34	+ 88
23.38	+ 145	28.31	+ 136
28 38	— 156	Nov. 1.31	+ 248
Oct. 13.32	+ 202	2.30	+ 198
14.29	+ 152	3.31	+ 228
15.40	+ 92	1849.	
20.31	— 187	Jan. 12.29	— 132

"The sign + indicates that the satellite follows Saturn, and — that it precedes the planet. Owing to the faintness of the new satellite, the distances above given are liable to errors of observation, amounting to three or four seconds. It was found best to refer Hy-

perion to the limb of Saturn through an intermediate satellite or star. The presence of moonlight, or even the near proximity of Saturn, affects its visibility in a much greater degree than is the case with Mimas, the inner body of the system.

"The following elements, representing somewhat roughly the above places, have been computed by Mr. G. P. Bond.

Period of revolution, 21.18 days.

Mean distance, 214" at the mean distance of Saturn.

Eccentricity, 0.115

Mean anomaly, 97° Jan. 1st, 1849.

Perisaturnium, 295°

"The line of nodes and the inclination of the orbit coincide nearly with those of the ring."

4. Observations on Petersen's Second Comet, made at the Cambridge Observatory.

- Corrected for refraction, and referred to the Mean Equinox of Jan. 1st, 1848.

Cambridge Mean Solar Time.			Comet's		Star of Comparison.		No. of Comp.	
			A. R.	Dec.	A. R.	Dec.		
1848, d.	h. m. s.	h. m. s.						
Nov. 25	6 56 41	20 35 11.2	+	37 24 15	20 40 03.75	+	33 24 13.8	2
27	6 58 34	20 43 45.8		34 52 24	20 43 12.06		35 00 15.5	6
28	6 55 53	20 47 58.3		33 34 54	20 40 03.75		33 24 13.8	3
29	6 55 16	20 52 10.5		32 16 04	20 40 03.75		33 24 13.8	1
30	8 20 36	20 56 35.6		30 51 18	20 59 22.45		30 57 32.7	3
Dec. 18	7 18 45	22 04 15.3		6 13 02	22 04 19.51		6 08 58.3	3
19	7 34 09	22 07 39.0	+	4 54 25	22 06 25.42	+	5 01 41.0	4
1849, Jan. 22	6 42 22	23 42 13.2	-	27 10 19	23 36 34.00	-	27 05 15.9	2

"Nov. 25th. The comet was first seen at 6^h 30^m; it shows a finely marked nucleus, with a tail of 15' or 20'.

"At 6^h 56^m 41^s, M. S. T., it followed a star of the 9th magnitude by 0^m 25^s.60, and was north of it by 2' 25".1, by ten micrometric comparisons. The centre is so well defined that the relative places of the star and comet may be found with great nicety. The A. R. and Dec. on the 25th, 28th, and 29th are from instrumental comparisons.

"Nov. 30th. The nucleus passed within one second of arc of a star of the 12th magnitude; both appeared of the same magnitude, and formed a close double star, but were not in contact; at the time of nearest approach, the comet *could be seen to move*.

"Dec. 18th. Tail of the comet 2° in length. There are traces of a secondary tail, at an angle of 10° or 20° with the principal one.

"Dec. 19th. The breadth of the tail in its brightest part, at 20' from the nucleus, is only about one minute of arc.

"Jan. 22d. Altitude of the comet at the observation = 8°."

5. *Moon Culminations observed at Cambridge.*

Lon. West of Greenwich, 4 h. 44 m. 32 s.

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabu- lar A. R.	Diff. s.	Obser- ver's Initial.
		h.	m.	s.			
1847, Sept. 17	♂'s 1st Limb	17	42	19.92			B ¹ *
"	γ Draconis	17	53	04.57	04.56	— 0.01	"
"	μ ¹ Sagittarii	18	04	39.82	39.82	0.00	"
28	Aldebaran	4	27	12.66	12.26	— 0.40	"
"	♂'s 1st Limb	4	42	46.55			"
"	ι Tauri	4	54	00.26	00 63	+ 0 37	"
"	Capella	5	05	27.93	27.98	+ 0.05	"
"	β Tauri	5	16	40.74	40.93	+ 0.19	"
"	α Leporis	5	26	02.21	02.24	+ 0.03	"
"	α Orionis	5	46	56.25	56.22	— 0.03	"
Oct. 3	δ Geminorum	7	11	01.60	01.56	— 0.04	"
"	α ² Geminorum	7	24	52.64	52.64	0.00	"
"	β Geminorum	7	35	59.26	59.36	+ 0.10	"
"	♂'s 2d Limb	9	17	56.02			B ²
23	ι Piscium	23	32	08.35	08.40	+ 0.05	B ¹
"	ε Piscium	1	00	33.28	33.58	+ 0.30	"
"	μ Piscium	1	22	14.19	14.05	— 0.14	"
"	♂'s 1st Limb	2	05	35.53			"
"	♂'s 2d Limb	2	06	57.22			"
"	ξ ² Ceti	2	20	05.92	05.81	— 0.11	"
"	μ Ceti	2	36	45.02	44.43	— 0.59	"
Nov. 1	ε Hydræ	8	38	43.10	43.13	+ 0.03	"
"	α Hydræ	9	20	06.34	06.57	+ 0.23	"
"	ε Leonis	9	37	12.19	11.94	— 0.25	"
"	α Leonis	10	00	15.60	15.52	— 0.08	"
"	♂'s 2d Limb	10	38	07.95			"
1848, Feb. 18	ξ Leonis	9	23	45.95	46.65	+ 0.70	"
"	ο Leonis	9	33	03.95	03.79	— 0.16	"
"	α Leonis	10	00	18.03	18.03	0.00	"
"	♂'s 1st Limb	10	04	17.43			"
"	♂'s 2d Limb	10	06	24.67			"
"	b ¹ Leonis	10	17	15.94	15.90	— 0.04	"
"	ρ Leonis	10	24	50.01	49.92	— 0.09	"
Feb. 25	f Libræ	15	25	53.28	53.16	— 0.12	"
"	♂'s 2d Limb	15	42	50.66			"
"	β ¹ Scorpii	15	56	37.16	37.20	+ 0.04	"
"	δ Ophiuchi	16	06	23.19	23.66	+ 0.47	"
27	♂'s 2d Limb	17	27	27.92			B ²
"	α Lyræ	18	31	47.01	47.08	+ 0.07	"
March 11	γ Tauri	4	11	09.26	09.25	— 0.01	B ¹
"	α Tauri	4	27	12.69	12.67	— 0.02	"
"	♂'s 1st Limb	5	09	47.69			"
"	ζ Tauri	5	28	34.43	34.56	+ 0.13	"

* B¹ is the initial of *W. C. Bond*; B², that of *G. P. Bond*.

Date.	Name of Object.	Sidereal Time of Meridian Passage.			Seconds of Tabu- lar A. R.	Diff.	Obser- ver's initial.
		h.	m.	s.			
1848, March 11	δ Geminorum	7	11	03.83	03.74	— 0.09	B ¹
14	δ Geminorum	7	11	03.74	03.69	— 0.05	"
"	α^2 Geminorum	7	24	54.95	54.95	0.00	"
"	κ Geminorum	7	35	17.40	17.18	— 0.22	"
"	$\mathfrak{D}$'s 1st Limb	8	02	24.86			"
"	ϑ Cancri	8	22	56.76	56.80	+ 0.04	"
"	δ Cancri	8	36	03.85	03.84	— 0.01	"
15	ϑ Cancri	8	22	56.68	56.79	+ 0.11	"
"	δ Cancri	8	36	03.89	03.82	— 0.07	"
"	$\mathfrak{D}$'s 1st Limb	8	56	47.74			"
"	ξ Leonis	9	23	46.77	46.56	— 0.21	"
"	σ Leonis	9	33	03.78	03.71	— 0.07	"
16	ξ Leonis	9	23	46.44	46.55	+ 0.11	"
"	σ Leonis	9	33	03.71	03.70	— 0.01	"
"	$\mathfrak{D}$'s 1st Limb	9	47	02.49			"
"	π Leonis	9	52	12.29	12.30	+ 0.01	"
"	α Leonis	10	00	18.00	18.01	+ 0.01	"
18	d Leonis	10	52	44.30	44.29	— 0.01	B ²
"	χ Leonis	10	57	12.18	12.39	+ 0.21	"
"	δ Leonis	11	06	02.76	02.79	+ 0.03	"
"	δ Hyd. et Crat.	11	11	46.96	46.67	— 0.29	"
"	$\mathfrak{D}$'s 1st Limb	11	24	31.44			"
"	ν Leonis	11	29	11.86	11.74	— 0.12	"
April 14	δ Leonis	11	06	02.65	02.65	0.00	B ¹
"	$\mathfrak{D}$'s 1st Limb	11	09	15.13			"
15	δ Leonis	11	06	02.44	02.65	+ 0.21	"
"	σ Leonis	11	13	19.59	19.51	— 0.08	"
"	τ Leonis	11	20	08.86	08.84	— 0.02	"
"	β Leonis	11	41	19.79	19.87	+ 0.08	"
"	π Virginis	11	53	07.05	06.96	— 0.09	"
"	$\mathfrak{D}$'s 1st Limb	11	55	20.73			"
"	η Virginis	12	12	09.85	09.70	— 0.15	"
17	β Leonis	11	41	19.92	19.86	— 0.06	"
"	β Corvi	12	26	26.72	26.95	+ 0.23	"
"	α Virginis	13	17	13.73	13.65	— 0.08	"
"	$\mathfrak{D}$'s 1st Limb	13	29	53.13			"
"	$\mathfrak{D}$'s 2d Limb	13	31	56.11			"
"	κ Virginis	14	04	49.98	49.78	— 0.20	"
May 15	m Virginis	13	33	40.42	40.56	+ 0.14	"
"	η Bootis	13	47	28.74	28.74	0.00	"
"	$\mathfrak{D}$'s 1st Limb	14	01	42.01			"
17	α^2 Libræ	14	42	31.26	31.21	— 0.05	"
"	ξ^2 Libræ	14	48	34.45	34.14	— 0.31	"
"	β Libræ	15	08	52.47	52.42	— 0.05	"
"	$\mathfrak{D}$'s 1st Limb	15	39	23.86			"
"	$\mathfrak{D}$'s 2d Limb	15	41	31.12			"
"	δ Scorpii	15	51	23.92	23.95	+ 0.03	"

Date.	Name of Object.	Sidereal Time of Meridian Passage			Seconds of Tabu- lar A. R.	Diff.	Obser- ver's initial.
		h.	m.	s.			
1848, May 17	β^1 Scorpii	15	56	38.47	39.00	+ 0.53	B ¹
June 10	γ Virginis	12	33	59.42	59.16	- 0.26	B ²
"	$\mathfrak{D}$'s 1st Limb	12	58	30.67			"
"	ϑ Virginis	13	02	06.90	06.89	- 0.01	"
12	α Virginis	13	17	13.28	13.48	+ 0.20	B ¹
"	κ Virginis	14	04	49.86	49.82	- 0.04	"
"	λ Virginis	14	10	55.61	55.85	+ 0.24	"
"	$\mathfrak{D}$'s 1st Limb	14	31	47.76			"
"	α^2 Libræ	14	42	31.49	31.21	- 0.28	"
"	ξ^2 Libræ	14	48	33.81	34.16	+ 0.35	"
July 10	β Libræ	15	08	52.39	52.32	- 0.07	B ²
"	$\mathfrak{D}$'s 1st Limb	15	03	23.70			"
"	γ Libræ	15	27	04.48	04.33	- 0.15	"
"	η Libræ	15	35	34.46	34.54	+ 0.08	"
11	α Serpentis	15	36	49.24	49.23	- 0.01	B ¹
"	$\mathfrak{D}$'s 1st Limb	15	53	11.79			"
"	ν Scorpii	16	03	12.94	12.84	- 0.10	"
"	δ Ophiuchi	16	06	25.46	25.54	+ 0.08	"
"	ψ Ophiuchi	16	15	15.74	15.68	- 0.06	"
12	ψ Ophiuchi	16	15	15.80	15.68	- 0.12	B ²
"	α Scorpii	16	20	08.74	08.78	+ 0.04	"
"	$\mathfrak{D}$'s 1st Limb	16	44	43.65			"
"	φ Ophiuchi	17	11	56.99	56.64	- 0.35	"
14	μ^1 Sagittarii	18	04	43.55	43.55	0.00	B ¹
"	λ Sagittarii	18	18	38.30	38.69	+ 0.39	"
"	$\mathfrak{D}$'s 1st Limb	18	32	37.92			"
"	π Sagittarii	19	00	46.26	46.35	+ 0.09	"
17	ν Aquarii	21	01	21.33	21.31	- 0.02	B ²
"	$\mathfrak{D}$'s 2d Limb	21	21	46.94			"
"	β Aquarii	21	23	35.97	35.97	0.00	"
"	δ Capricorni	21	38	41.52	41.26	- 0.26	"
18	δ Capricorni	21	38	41.36	41.28	- 0.08	"
"	ι Aquarii	21	58	15.83	15.91	+ 0.08	"
"	$\mathfrak{D}$'s 2d Limb	22	16	52.32			"
"	σ Aquarii	22	22	38.36	38.43	+ 0.07	"
Aug. 7	α Virginis	13	17	12.85	12.85	0.00	"
"	$\mathfrak{D}$'s 1st Limb	15	32	53.81			"
9	$\mathfrak{D}$'s 1st Limb	17	20	28.00			"
"	ξ Serpentis	17	28	56.17	56.00	- 0.17	B ¹
10	ξ Serpentis	17	28	56.24	55.99	- 0.25	"
"	$\mathfrak{D}$ Ophiuchi	17	34	22.42	22.37	- 0.05	"
"	$\mathfrak{D}$'s 1st Limb	18	09	14.39			"
"	A. S. C. 2125	18	20	35.16	35.10	- 0.06	"
"	ν^1 Sagittarii	18	45	02.56	02.60	+ 0.04	"

"The above are corrected for known instrumental errors and for the rate of the chronometer. The Seconds of Tabular Right Ascension are taken from the Nautical Almanac."

6. *Double Stars observed at Cambridge Observatory. — 1848 — 49.*

Name of Star.	Date.	A. R. h. m.	Dec.	Pos.	Dist.	No. of Obs.	Pow- er.	Obs- er.	Remarks, Magnitudes, &c.
170 P. VII.	1848.27	7 32	+ 5 36	142 40	1.3	4	140	B ¹	The two components make a star of the 7th or 8th magnitude. A = 1st, 2d, B = 3d.
α ² Geminorum	1848.30	7 24	+ 32 14	249 45	5.1	5	860	B ¹	
"	.26			249 20	5.3	5	860	B ¹	
ζ Cancri	1848.25	8 03	+ 18 06	342 45	5.2	5	860	B ²	A and B. A and C. A = 4th, B = 5th, 6th.
"	.30			248 40	1.0	4	860	B ¹	
"	.25			342 45	5.6	4	860	B ¹	
ξ Ursæ Majoris	1848.45	11 09	+ 32 24	128 30	2.7	5	860	B ¹	Seen through dense clouds; the definition is good.
"	.45			129 45	3.1	5	860	B ²	
"				129 45	2.9	4	860	B ²	
γ Leonis	1848.27	10 11	+ 20 37	108 20	2.9	4	860	B ¹	The images of the stars are pretty well defined, though not good. A = 3d orange, B = 7th green. A = 3d golden, B = 7th blue or greenish.
γ Virginis	1848.45	12 33	— 0 37	179 15	2.5	10	860	B ¹	
"	.45			181 30	2.7	2	860	B ²	
ζ Bootis	1848.38	14 34	+ 14 23	130 40	1.3	5	860	B ¹	Very unsteady images.
"	.38			129 30	1.3	5	860	B ¹	
"	.45			322 00	3.2	5	860	B ²	
ε Bootis	1848.38	14 38	+ 27 43	326 45	3.2	5	860	B ²	Pretty good vision. Stars well separated.
"	.38			322 00	3.1	5	860	B ²	
"	.45			322 05	4.5	5	860	B ²	
44 Bootis	1848.55	14 58	+ 48 15	237 00	4.5	5	860	B ¹	Images unsteady.
"	.55			240 00	4.3	5	860	B ¹	
"	.54			239 30	4.3	5	860	B ¹	
η Coronæ Borealis	1848.58	15 17	+ 30 52	207 20	0.8	5	860	B ¹	Not a favorable evening for close objects, but the components are separated with [certainty.
"	.66			210 20	0.8	5	1560	B ²	
"				210 20	0.5	5	1560	B ¹	
α ² Bootis	1848.53	15 18	+ 37 53	2-2 00	0.5	5	1240	B ²	Images unsteady.
"	.52			2-3 00	0.5	5	1240	B ²	
"	.51			252 52	0.7	5	1240	B ¹	
"	.51			252 52	0.7	5	1240	B ¹	Not a favorable evening for close objects, but the components are separated with [certainty.
"	.49			253 40	0.6	5	1560	B ²	
"				253 40	0.3	5	1560	B ²	
γ Coronæ Borealis	1848.51	15 36	+ 26 46	234 45	0.3	5	1240	B ²	Not a favorable evening for close objects, but the components are separated with [certainty.
"	.49			250 30	0.3	5	1240	B ²	
"	.46			253 00	0.3	4	1240	B ²	
Antares	1848.98	16 19	— 26 06	275 20	3.8	12	400	B ¹	Not a favorable evening for close objects, but the components are separated with [certainty.
"	.28			277 00	3.8	12	400	B ¹	
"				277 00	3.8	3	400	B ²	

Name of Star.	Date.	A. R. h. m.	Dec.	Pos.	Dist.	No. of Obs.	Pow. er.	Obs- erver.	Remarks, Magnitudes, &c.
Antares	1848.49	16 19	— 26 06	272 45	3.6	5	1560 B ²		Very fine definition.
"	.58			273 10	3.6	5	860 B ¹		
"	.55			272 00	3.4	5	860 B ¹		Bad definition.
σ Coronæ Borealis	1848.42	16 08	+ 34 14	171 15	2.2	5	860 B ¹		
"	.42			172 30	2.2	4	860 B ²		
λ Ophiuchi	1848.56	16 23	+ 2 18	9 50	1.4	10	860 B ¹		When the micrometer-wires are set at 1", both wires are decidedly within the stars.
New Star	1848.40	16 51	— 12 39	212 30	115.6	5	220 B ¹		A = 6th, B = 15th. A resembles Antares to the naked eye, but its red is deeper.
"	.41			211 20	115.1	5	140 B ¹		{ It is one of the most strikingly colored stars we remember to have seen.
"	.41			212 30	118.1	5	140 B ²		{ On the 29th of June this star was seen with thirty companions of from the 15th
"	.42			212 00	114.9	5	140 B ¹		{ to the 20th magnitudes, within a radius of 6'.
"	.44			212 08	115.0	3	140 B ²		With a power of 1500 there is no sign of a planetary disk under fine definition.
"	.55			212 30	115.2	5	140 B ²		A = 7th, 8th, B = 14th. A appears to have decreased in brilliancy; its ruby-red
"	.62			211 57	115.4	3	140 B ²		color still remains. The star is at once recognized from its neighbours by its
"	.63			211 13	116.1	5	140 B ¹		color alone.
"	.64			212 27	115.4	10	320 B ²		A = 7th, 8th, B = 15th. A is sensibly less than when first seen.
"	.66			212 30	115.5	5	400 B ¹		
36 Ophiuchi	1848.55	17 05	— 26 22	215 30 ²	4.3	5	860 B ¹		The position-angle does not agree with its computed value.
α Ophiuchi	1848.55	17 07	+ 14 33	176 45	22.9	5	860 B ¹		A = 3d, B = 8th.
70 Ophiuchi	1848.52	17 57	+ 2 32	118 07	6.9	5	1560 B ¹		A = 4th, B = 6th. B has a reddish tinge.
"	.52			117 45	6.8	5	1560 B ²		
ε Lyre	1848.47	18 39	+ 39 30	21 04	3.1	5	860 B ¹		A and B.
"	.47			172 50	207.1	5	860 B ¹		A and C.
"	.47			149 00	2.5	5	860 B ¹		C and D.
Ring Nebulæ	1848.41	18 48	+ 32 50	66 00	73.3	5	140 B ¹		Longer axis of the ring.
"	.41				60.4	5	140 B ¹		Shorter axis.
α Cygni	1848.41	20 36	+ 44 43	88 35	95.5	5	140 B ¹		Companion star 12th magnitude.
β Cygni	1848.25	19 24	+ 27 39	55 55	33.5	5	140 B ¹		Seeing not good.
16 β Delphini	1848.56	20 24	+ 10 44	209 50	0.5	3	860 B ²		
γ Virginis	1849.45	12 03	— 0 37	179 49	3.0	10	860 B ¹		
"	.45			179 45	3.0	5	860 B ²		
Antares	1849.52	16 19	— 26 06	270 27	3.4	10	860 B ¹		